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Niagara
Escarpment



Ontario's Niagara Escarpment (Ontario, Canada): Implementing the Biosphere Reserve Concept in a Highly Developed Region



This paper was prepared at the request of the United Nations Educational, Scientific and Cultural Organization (UNESCO) for presentation by the Niagara Escarpment Commission at the International Conference on Biosphere Reserves held in Sevilla, Spain, March 20-25, 1995.

In 1990, the Niagara Escarpment was designated a World Biosphere Reserve by UNESCO. It is one of 324 biosphere reserves in 82 countries. There are six such reserves in Canada. A biosphere reserve is an area which UNESCO chooses as representative of the world's important ecosystems. Each reserve is intended to be a demonstration area for both the conservation of biological diversity and the promotion of environmentally appropriate development.



Ontario's Niagara Escarpment (Ontario, Canada): Implementing the Biosphere Reserve Concept in a Highly Developed Region

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I Introduction

The Niagara Escarpment is the most prominent topographical feature of the southern part of Ontario, Canada's most populous province. The largely forested corridor which defines the Escarpment is 725 km in length and passes through the most heavily developed region of Canada. It is also an area with a rich agricultural heritage; agricultural production ranges from vineyards, tender fruit and mixed farming in the south to apples and beef cattle further north.

In geological terms, a cuesta or escarpment is a ridge composed of gently tipped rock strata with a long, gradual slope on one side and a relatively steep scarp or cliff on the other. The Niagara Escarpment is as much a hydrological as a geological feature. The headwaters of several rivers rise in the Escarpment and the area is important for groundwater recharge. The uncontaminated water of many Escarpment aquifers is in heavy demand from the bottled water industry. There are a number of spectacular waterfalls at the cliff edge, the most well known being Niagara Falls. Erosion through the millennia has created a magnificent gorge such that these falls on the Niagara River are now located 12 km upstream from the main Escarpment brow.

Although the population of the Niagara Escarpment biosphere reserve (area: 190,654 ha) is only approximately 120,000, an estimated seven million people live within 100 km of the reserve. This includes Toronto, the province's largest city, as well as upper New York State, U.S.A. (1.2 million). The Niagara Escarpment biosphere reserve was designated in 1990.



1. Tews Falls. Numerous waterfalls spill over the Escarpment face.

The location of the Niagara Escarpment is shown in Map 1. The biosphere reserve consists of the Niagara Escarpment Plan Area (defined by provincial legislation) and two national parks. The area covered by the Niagara Escarpment Plan is located within portions of 37 local municipalities, which are themselves parts of eight counties or regional municipalities. Data outlining the physical and biological features of the Niagara Escarpment biosphere reserve are presented in Figure 1.

In addition to the 1990 biosphere designation, international recognition for the Escarpment's significance as a natural feature came with the discovery in 1988 of small, gnarled Eastern White Cedar trees (*Thuja occidentalis*) at the cliff edges and on the cliff faces. With some specimens as old as 1000 years, these trees of "bonsai" proportions are the oldest in eastern North America.

Land use control in the biosphere reserve is achieved through implementation of the Niagara Escarpment Plan, a land use plan first conceived by the Ontario government in 1973 and approved in 1985. Legislation governing the Escarpment required the Plan to be reviewed after five years in operation. The first review began in 1990 and led to a re-affirmation of the original plan's intent in a more protective, revised plan approved in 1994.

II Historical Context for the Niagara Escarpment Biosphere Reserve

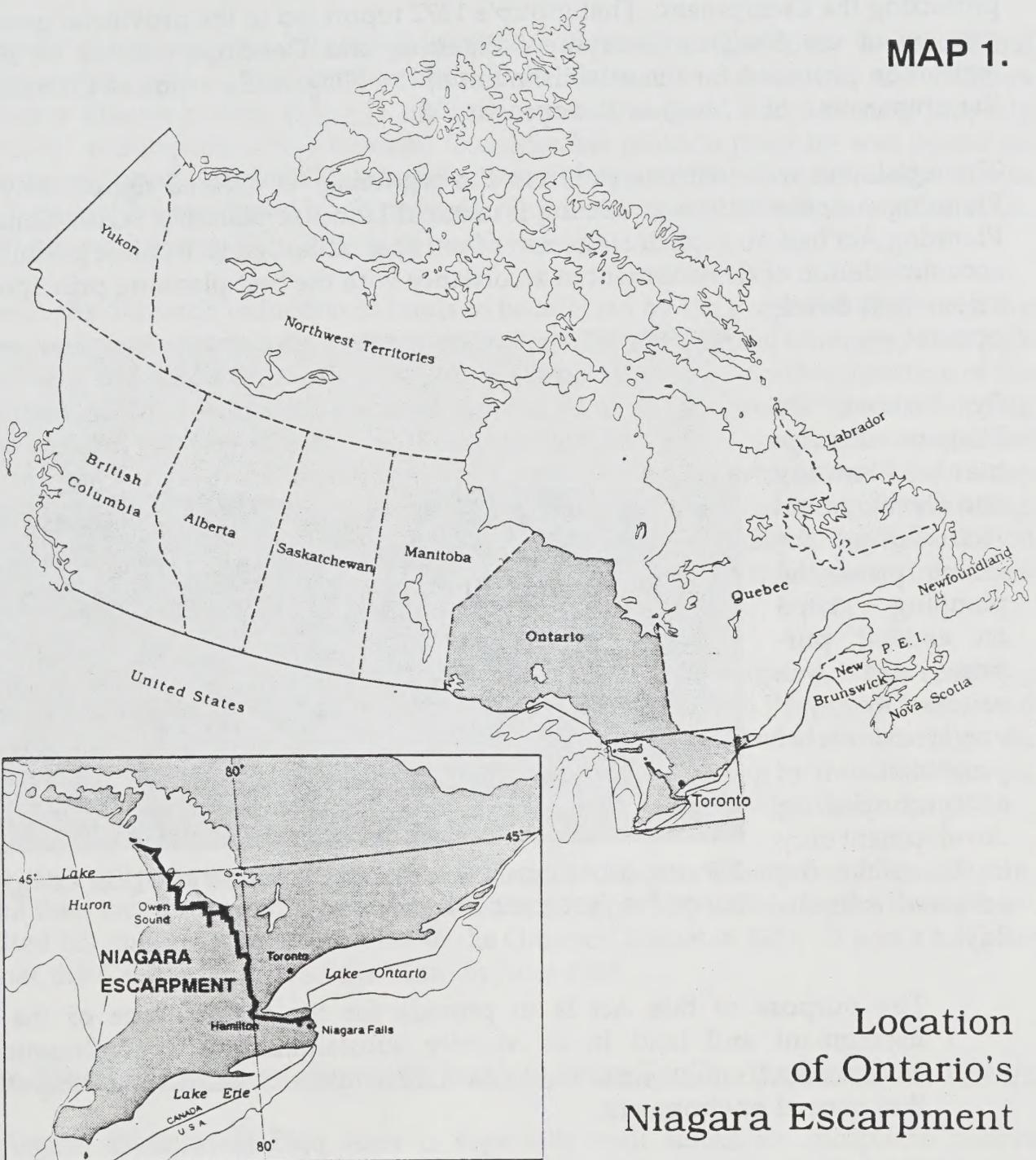
In the 1960s, public concern in Ontario arose surrounding inadequate protection for the Niagara Escarpment. The sand, gravel and limestone of the Escarpment were providing high quality mineral resources for industrial purposes, but the very landform itself was in jeopardy. From a point west of Toronto, along the most heavily travelled highway in Canada, the passing motorist could see a large gap blasted out of the Escarpment cliff face – a highly visible example of environmental damage.

By 1967, the Ontario premier called for "a wide-ranging study of the Niagara Escarpment with a view to preserving its entire length." The study was completed in 1968. A task force was struck to determine how best to implement the study's recommendations for



2. Cedar trees cling to the Escarpment face -- the oldest trees in eastern North America.

MAP 1.

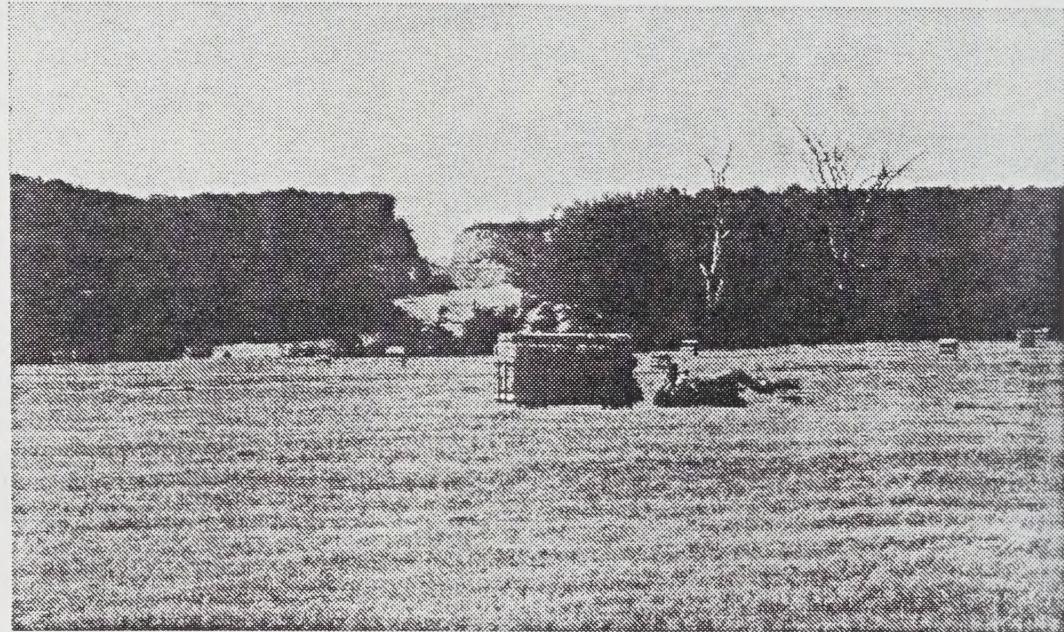


Location
of Ontario's
Niagara Escarpment

protecting the Escarpment. That group's 1972 report led to the provincial government's passage of the Niagara Escarpment Planning and Development Act in 1973. The legislation provided for the establishment of the Niagara Escarpment Commission and the preparation of a Niagara Escarpment Plan.

The legislation was controversial from the beginning. It differed significantly from the Planning Act, the statute governing municipal land use planning across Ontario. The Planning Act had no explicit statement of purpose, although its implicit premise was the accommodation of development in accordance with the best planning principles. It was oriented to development.

By contrast, the Niagara Escarpment Planning and Development Act allowed for direct provincial planning, stated an explicit purpose and was oriented to environmental protection, accommodating development only if it could be achieved compatibly:



3. Inadequate controls in the past resulted in a gap being quarried out of the Escarpment face near Milton.

The purpose of this Act is to provide for the maintenance of the Niagara Escarpment and land in its vicinity substantially as a continuous natural environment, and to ensure only such development occurs as is compatible with that natural environment.

(Section 2, Niagara Escarpment Planning and Development Act, Revised Statutes of Ontario)

The Niagara Escarpment Commission was created in 1973. In keeping with the Act, the Commission is composed of 17 people appointed by the Ontario premier. There are eight appointed members who are elected representatives from the municipalities in the Plan Area and nine who are citizens representing the general public, one of whom is the chairperson. Members typically are appointed for two periods totalling six years.

Preliminary proposals for a Niagara Escarpment Plan were released by the provincial government in 1978. The land proposed for inclusion was called the Niagara Escarpment Planning Area (Map 2). Negative reaction from many private property owners and municipalities was intense. Considerable political pressure was placed on the government such that in 1979, when the actual Proposed Plan was released, the area of coverage had been reduced by 63 per cent. This is the Niagara Escarpment Plan Area. Over 90 per cent of the Plan Area is privately owned.

Even with the dramatic reduction in lands to be affected by the Proposed Plan, negative reaction continued. It was a difficult period in Canada's agricultural economy, with high interest rates and banks foreclosing on farmers, especially in the northern portion of the Escarpment. Land developers saw the Proposed Plan as an obstacle to rural housing projects and the creation of new building lots. Restrictive land use controls could not have been put forward at a worse time socioeconomically. It was a time when many municipal councils in Ontario were only just beginning to practise land use planning, and now, in addition to local plans, a provincial plan was going to be imposed on landowners in the Plan Area. Some citizens viewed it as outside interference in matters which should be dealt with locally.

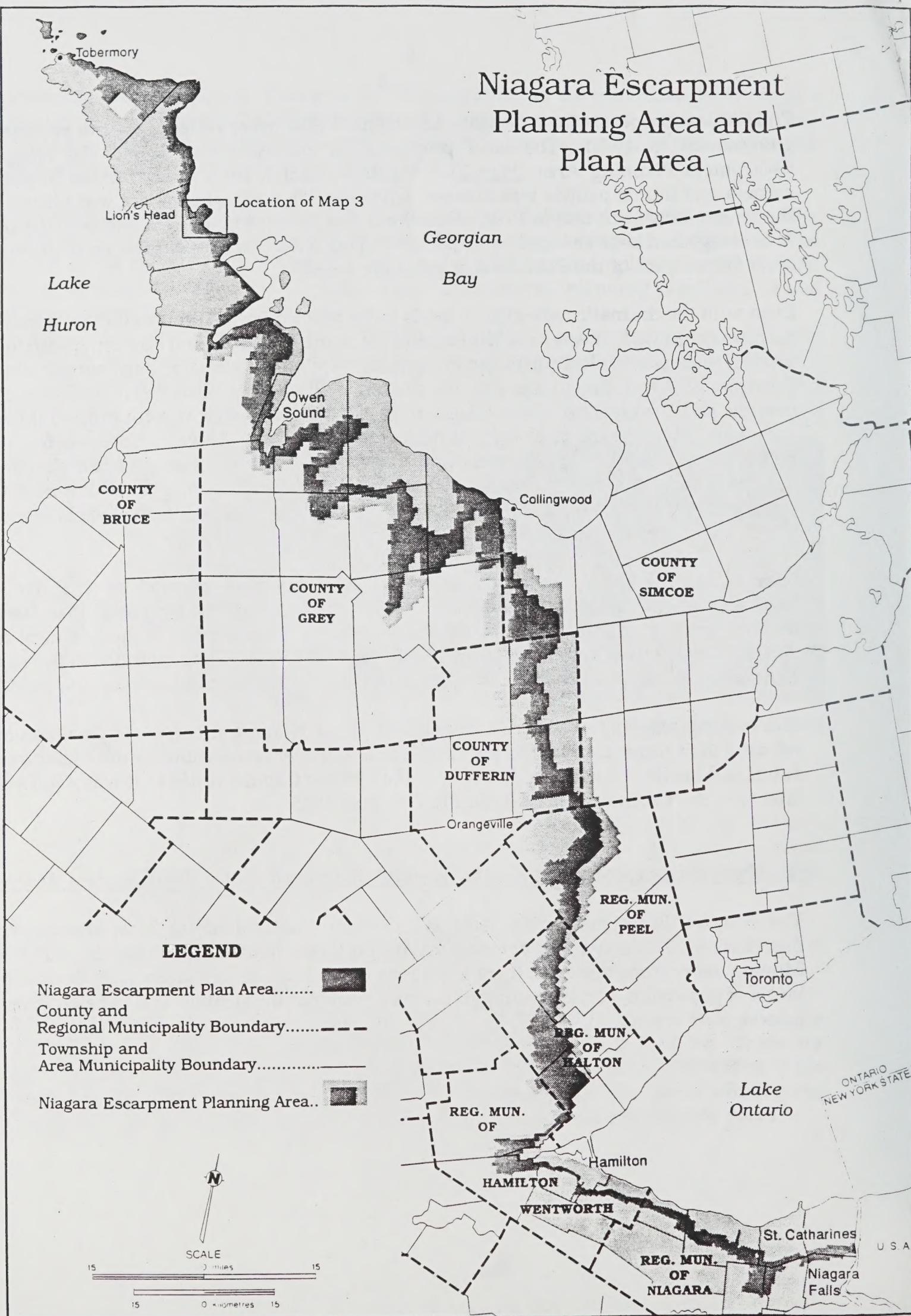
Niagara Escarpment Commission members themselves were targeted, some receiving shotgun shells anonymously in the mail. Public hearings on the Proposed Plan lasted for 26 months, beginning in 1980. On the first day of one segment of the hearings, the Ontario premier was hanged in effigy outside the hearing building by irate landowners. The hearings themselves were disrupted and police were required to keep the peace.

The hearing officers, who were independent of the Niagara Escarpment Commission, released their recommendations in 1983, and the minister responsible for the Escarpment submitted his final recommended Plan to the Ontario Cabinet in 1984. It was a full year later that the Cabinet approved the Plan, in June 1985.

III The Niagara Escarpment Plan as the Implementing Tool for the Biosphere Reserve

The Niagara Escarpment Plan Area is especially well suited for biosphere reserve designation. There is a backbone of heavily protected lands at and near the cliff face. Moving away from this area, there is a series of land use designations with decreasing levels of protection, corresponding to the core, buffer and transition areas of a biosphere reserve.

MAP 2.



The seven land use designations in the Niagara Escarpment Plan are as follows (percentage of total Plan Area in parentheses):

Escarpmnt Natural Area	(26.4%)	core
Escarpmnt Protection Area	(36.8%)	buffer
Escarpmnt Rural Area	(29.3%)	buffer
Urban Area & Minor Urban Centre	(1.9%)	transition
Escarpmnt Recreation Area	(4.1%)	transition
Mineral Resource Extraction Area	(1.6%)	transition

Core and buffer designations constitute 92.5 per cent of the Plan Area. A representative portion of the Plan Area showing the configuration of the land use designations is shown in Map 3.

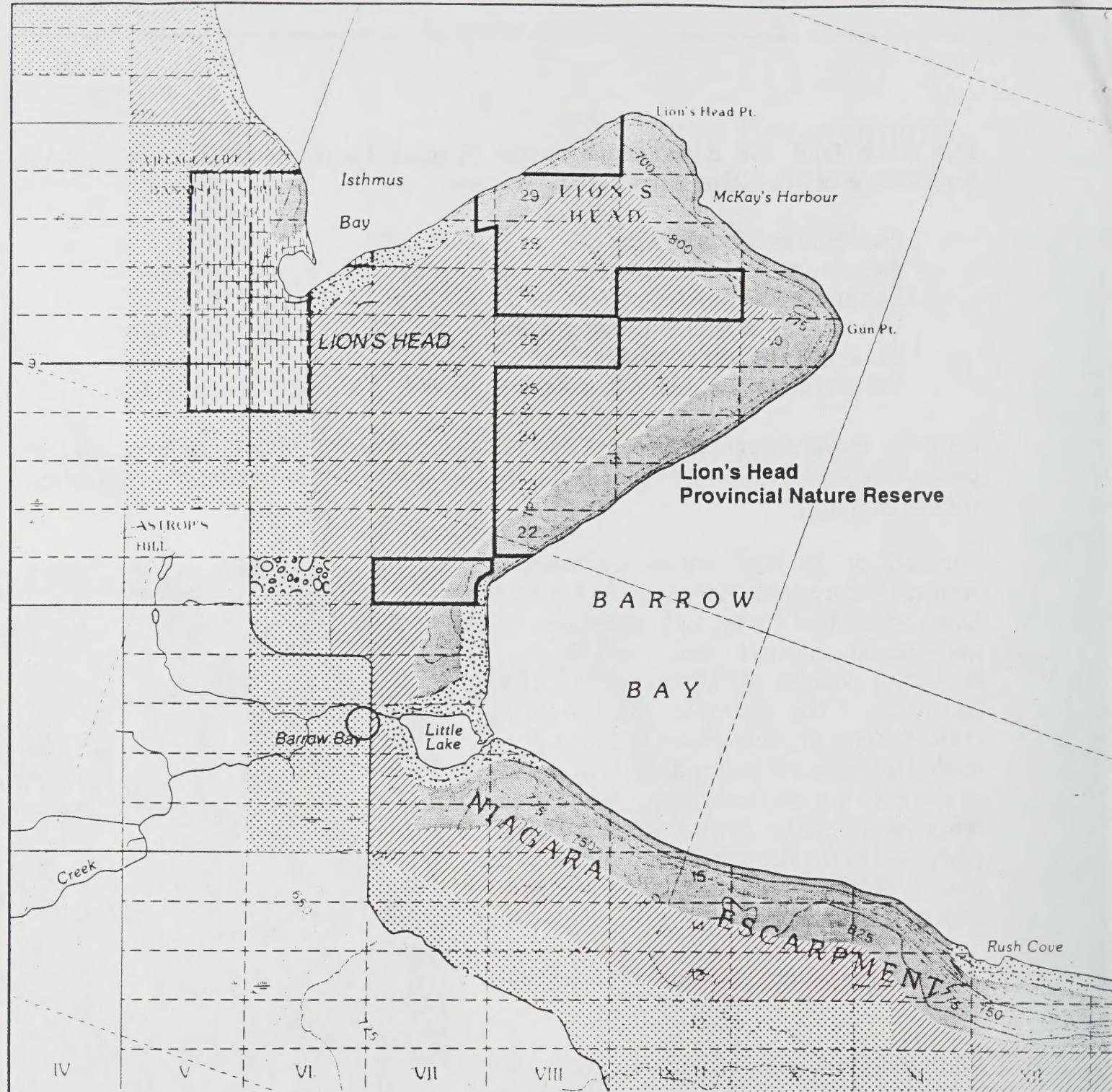
For each of the land use designations, the Niagara Escarpment Plan outlines the objectives, permitted uses and policies. The Escarpment Natural Area has the most restrictive policies, the Urban Areas the least restrictive. For example, with the 1994 revised Plan, no new building lots are permitted in either the Escarpment Natural Area or the Escarpment Protection Area, and only one new lot per original 40 hectare parcel is permitted in the Escarpment Rural Area. The overall objectives embodied in the Plan are stated in the legislation:

- (a) to protect unique ecologic and historic areas;
- (b) to maintain and enhance the quality and character of natural streams and water supplies;
- (c) to provide adequate opportunities for outdoor recreation;
- (d) to maintain and enhance the open landscape character of the Niagara Escarpment in so far as possible, by such means as compatible farming or forestry and by preserving the natural scenery;



4. Apples, Beaver Valley, Grey County.
Agricultural production is diverse.

MAP 3.



**Land Use Designations in the
Niagara Escarpment Plan Area:
Vicinity of Lion's Head, Bruce County**

LEGEND

Escarpmnt Natural Area		Urban Area	
Escarpmnt Protection Area		Escarpmnt Recreation Area	
Escarpmnt Rural Area		Mineral Resource Extraction Area	
Minor Urban Centre		Public Land (in Parks and Open Space System)	

NOTE: The Niagara Escarpment Plan designation boundaries shown on this map are approximate and subject to confirmation through Site Inspection and the application of the "Interpretation of Boundaries" section of the Niagara Escarpment Plan.

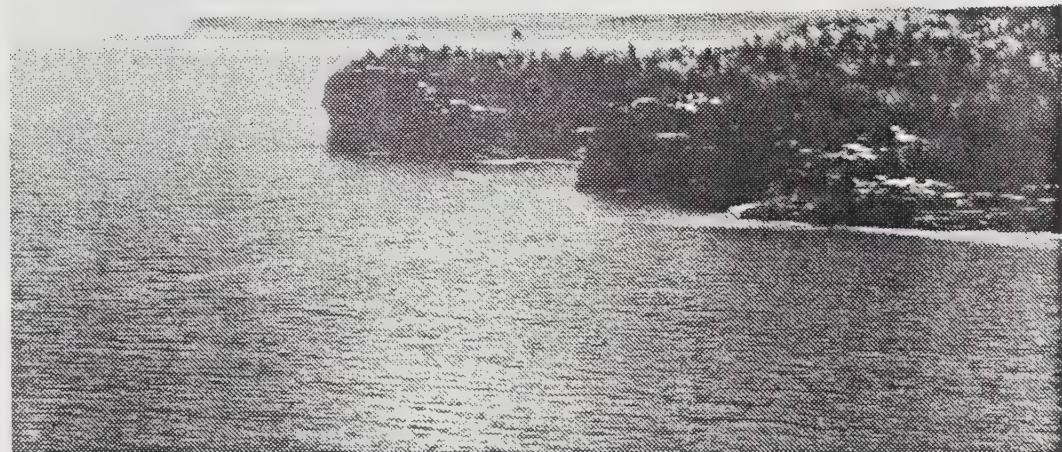
- (e) to ensure that all new development is compatible with the purpose of this Act as expressed in section 2;
- (f) to provide for adequate public access to the Niagara Escarpment; and
- (g) to support municipalities within the Niagara Escarpment Planning Area in their exercise of the planning functions conferred upon them by the Planning Act.

(Section 8, Niagara Escarpment Planning and Development Act, Revised Statutes of Ontario)

A separate section of the Plan includes development criteria to be applied throughout the Plan Area. These criteria cover matters such as protection of water quality, restrictions for developing on steep slopes and criteria for approving small-scale commercial uses accessory to agriculture (such as wineries in conjunction with vineyards). They also permit municipalities the flexibility to apply their own planning standards, provided that those standards do not conflict with the Niagara Escarpment Plan.

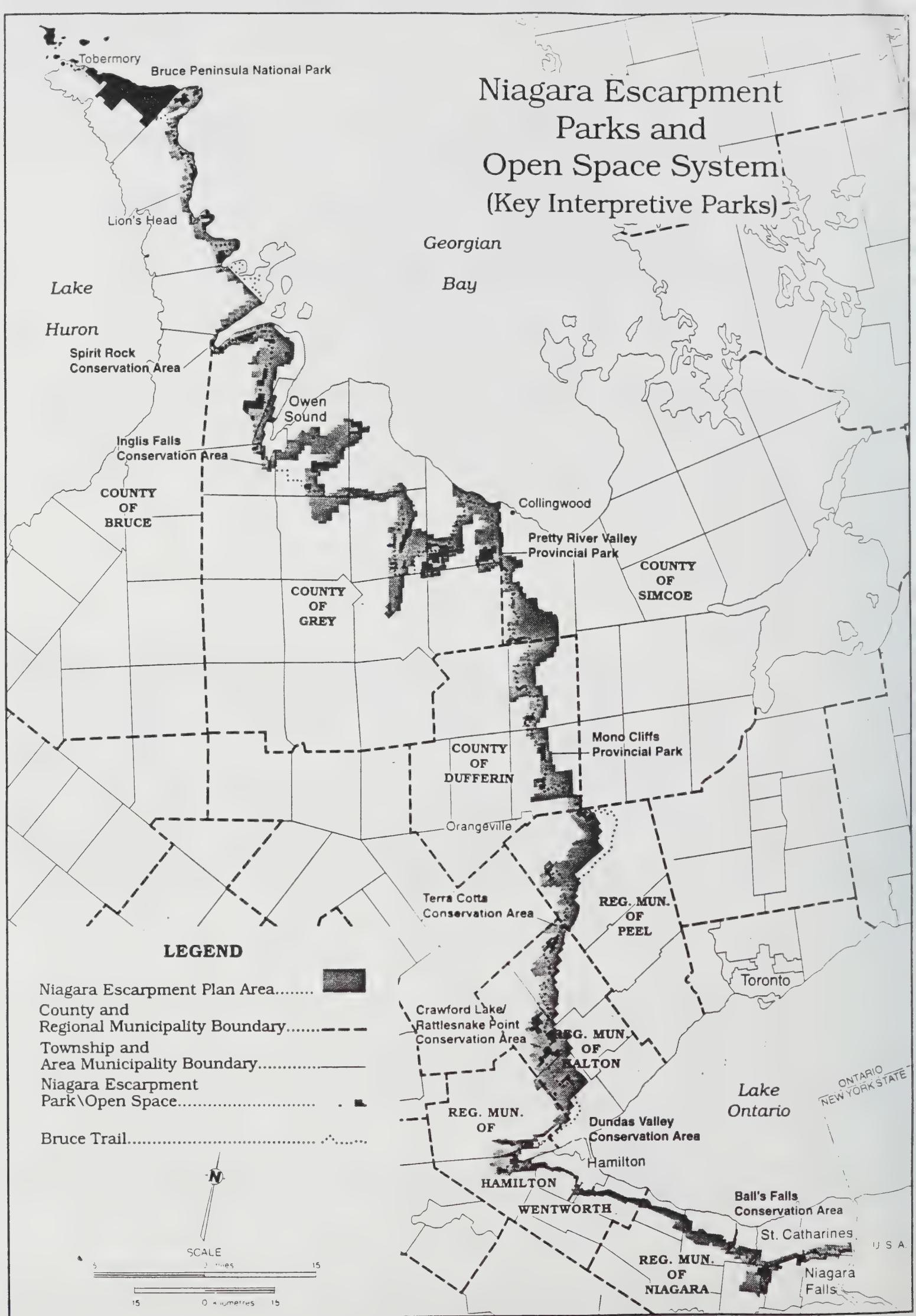
The third component of the Plan is the Niagara Escarpment Parks and Open Space System. It sets out policies for the parks system as a framework for the establishment and co-ordination of a network of publicly owned lands within the Plan Area.

There are over 100 existing and proposed public parks and open space areas, linked by the Bruce Trail. This trail is a continuous footpath running the entire length of the Plan Area, largely in the core Escarpment Natural Area. It is administered and maintained by the Bruce Trail Association, a non-government organization composed largely of volunteers. The Parks and Open Space System is shown in Map 4.



5. Bruce Peninsula National Park offers ready access to Georgian Bay on Lake Huron as well as hiking, camping and nature appreciation.

The land use legislation generally in force in Ontario - the Planning Act - authorizes each municipality to plan within its own boundaries. By contrast, the Niagara



Escarpment Planning and Development Act deliberately directs the Niagara Escarpment Commission to plan at the provincial level for ecosystems which transcend municipal boundaries. Given the purpose of the Act, the onus is properly on those who wish to develop to prove that their proposals are compatible with the Escarpment environment, rather than on the Niagara Escarpment Commission to provide absolute proof that a proposed development would be incompatible.

All proposals defined in regulation as "development" require a development permit from the Niagara Escarpment Commission. Examples of such developments include new single dwellings, road construction, sand and gravel pits, installation of irrigation or recreational ponds, altering the grade of the land, and changes in the use of existing structures.

The Niagara Escarpment Commission is a government agency at arm's length from the Ontario Ministry of Environment and Energy, to which it reports. The source of its annual budget of approximately Cdn. \$2.5 million is this "host" ministry, the budget of which, in turn, is determined by the provincial Cabinet. Like any other provincial agency, the Commission operates under administrative policies set by the government. However, in carrying out its mandate under the Niagara Escarpment Planning and Development Act, the Commission develops policies and takes positions on land use planning matters which are independent of the host ministry. The Commission has a staff of 40 located in three offices along the Escarpment.

Land use planners on staff at the Commission are responsible for working with development permit applicants to clarify and possibly improve their proposals. The planner then prepares a staff report with a recommendation to the Commission either to refuse the proposal or approve it with conditions. The 17-member Commission meets for one day every three weeks to render decisions. Its meetings are open to the public and are usually attended only by applicants or those opposing an applicant. Any applicant who wishes to address the Commission and answer questions may do so prior to the Commission making its decision. The Commission approves a large majority of all proposed developments. These approvals are always accompanied by numerous conditions to ensure that the development meets the environmental standards of the Plan. In 1994, 92 per cent were approved with conditions.

Applicants have a right of appeal of a Commission decision to the Minister of Environment and Energy. In that case, an independent hearing officer holds a hearing and makes a recommendation to the Minister. In addition to the applicants, all property owners within 120 metres of a subject property, and others who may be notified, have the right to appeal a Commission decision; a neighbour may, for example, object to a Commission decision.

A separate process is in place if someone wishes to obtain an amendment to the Niagara Escarpment Plan. An applicant may propose a development that is not a permitted use under the Plan within a particular land use designation; for example, a commercial

development outside the confines of an Urban Area or Minor Urban Centre. Other examples include requests to change the land use designation of a property (typically to a less restrictive one); to remove a property from the Plan Area entirely; or to add land to the Plan Area. The legislation stipulates a lengthy public participation process for Plan amendments, involving a public hearing with expert testimony and a final decision by the Ontario Cabinet.

The most far-reaching Plan amendment approved in recent years was the 1992 amendment which prohibited all future waste disposal sites in the Plan Area (e.g., landfill sites, incinerators) except through a site-specific amendment to the Plan. Members of the public who proposed this amendment to the Commission believed that the fractured limestone of the Escarpment would provide poor containment for toxic chemical leachate from landfill sites.

Finally, the Commission is a commenting agency for land use proposals outside its own administrative authority but with the potential for effects on the Niagara Escarpment, for example, environmental assessments of municipal road projects. In addition, Commission staff may appear before various land use planning tribunals to represent the Commission's interests in matters affecting the Plan Area.

Success in implementing the Niagara Escarpment Plan may be measured by the degree of public participation generated by the program. The competing pressures from different segments of the public for protection on one hand and development on the other mean that the Niagara Escarpment Commission is constantly under public scrutiny.

IV Environment versus Development: Four Issues in the Niagara Escarpment Biosphere Reserve

■ Mineral Resource Extraction: One of the primary issues leading to passage of the Niagara Escarpment Plan, mineral resource (aggregate) extraction, remains a significant pressure point. The aggregate industry promotes the high quality of material and the proximity to markets of the Escarpment's mineral resources. The conservation community generally believes that all aggregate extraction in the Plan Area should be prohibited, including the phasing out of existing operations. In keeping with the purpose of the legislation, the Plan and the Commission have a conservation orientation on the issue. The 1994 revision to the Plan tightened the development criteria for aggregate pits and quarries, in addition to placing an 18-month freeze on the processing of applications for new extraction areas.

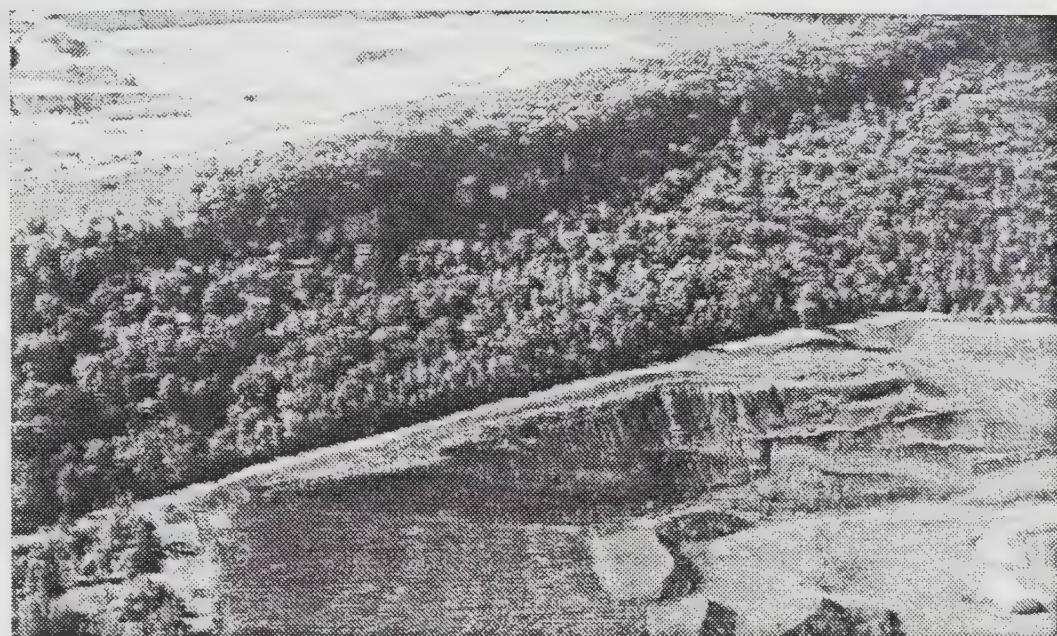
During the freeze, an Aggregate Advisory Committee, composed of representatives of the Commission, the industry, conservationists, municipalities and government ministries, is completing a study and will advise the Minister on whether the Plan Area should be excluded from further consideration as a source of future aggregate. The

Committee is examining environmental, economic and land use planning constraints to the use of alternative source areas for aggregate extraction.

■ Lot Creation in the Countryside:

The demand for new residential lots is high along the entire Escarpment, for both permanent dwell-

ings and vacation properties. The prospect of obtaining approval for a new building lot is attractive to some farmers experiencing economic difficulties. The demand for such lots comes primarily from urban dwellers seeking quiet, open space and a clean environment. The 1994 revisions to the Niagara Escarpment Plan deleted the provision for rural housing projects and reduced the permitted number of new lots that can be created. New lots are created by land division committees of municipal governments. As a result of Plan revisions, the Niagara Escarpment Commission objects to many of these new, residential lots because if created, they would exceed the lot density provisions of the Plan. A point will come within the next few years when the Plan Area is entirely "built out" or "severed out" -- that is, a point when all permitted lots will have been created. Controversy is inherent in the situation where the lot creation restrictions in the Plan Area are significantly tighter than those imposed by a local municipality immediately adjacent to the Plan Area. Land values on the Escarpment remain high, sometimes higher than areas outside. Land purchasers continue to seek a clean and protected environment, and appear willing to pay extra for it.



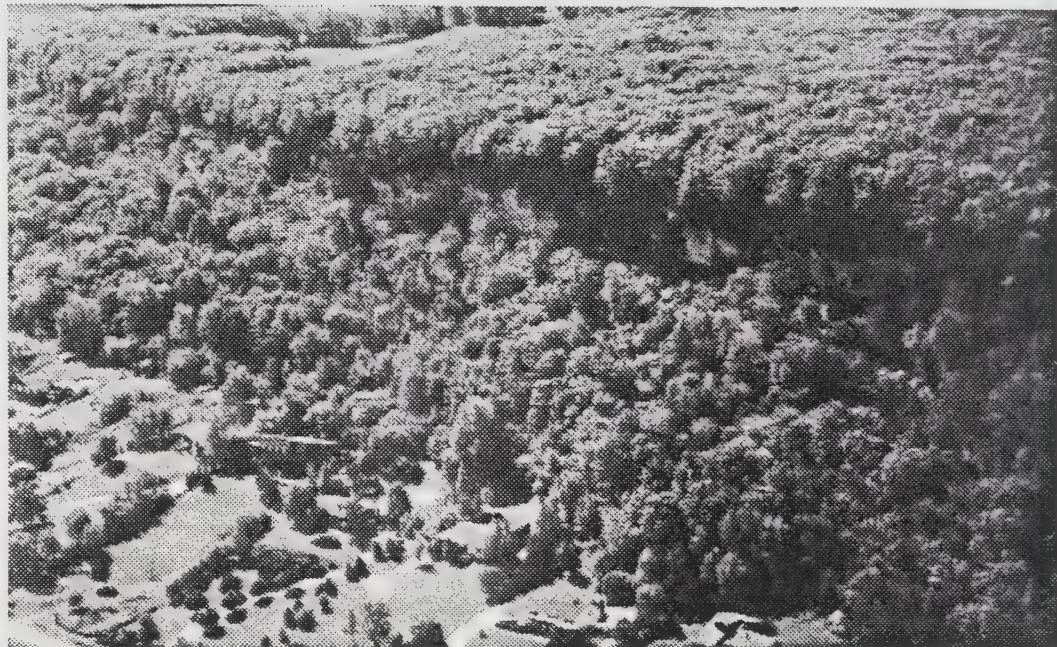
6. Aggregate extraction above and below the Escarpment face near Milton, west of Toronto.

The Plan contains a provision for a full-time, bona fide farmer (defined in the Plan) to obtain a farm retirement lot, as long as the permitted lot density in the area would not be exceeded. With many farmers seeking off-farm employment in difficult economic times, some do not meet the definition to qualify for this lot. For those who do qualify, many proceed to build a retirement home on the lot so that a family member can take over the farm operation. However, the farmer can also sell the retirement lot to a non-farm resident as a source of income.

■ Urban Sprawl: There is significant pressure to expand urban boundaries into the rural portions of the Niagara Escarpment Plan Area, especially in the southern section, which constitutes the heavily populated "Golden Horseshoe" at the west end of Lake Ontario. In a recent case under the Planning Act, hearing officers at the Ontario Municipal Board rejected the requests of private urban developers and a city government to expand that city's urban boundaries into the Escarpment Protection Area. The Niagara Escarpment Commission was a party to the hearing, objecting to the proposal.

The Niagara Escarpment Plan explicitly states that residential development is to be concentrated in the Urban Areas, Minor Urban Centres and

Escarpment Recreation Areas. Also, housing projects in the Escarpment Rural Area were prohibited in the revised 1994 Plan, further confining development to existing, built-up areas.



7. Pressure for rural residential lots is intense along the Escarpment, such as at the base of Mount Nemo, northeast of Hamilton.

■ A Clash of Values: As ex-urban dwellers migrate to the Niagara Escarpment countryside in increasing numbers, a clash of values often occurs with those whose families have lived there for generations. Ex-urbanites often continue to work in the cities, commuting long distances daily. They are sometimes criticized by the long-established local population for treating the Escarpment as their "weekend playground" and pushing for further protections. In doing so, they may be viewed as insensitive to the economic imperatives facing farmers and others dependent on the rural economy. These kinds of pressures are felt throughout southern Ontario, but are particularly intense along the Escarpment, where there is a provincially recognized resource that has garnered special attention and protection.

V Public and Private Interests in the Niagara Escarpment

As indicated above, public concern about protecting the Niagara Escarpment dates back some 30 years. Controversy about restrictive land use policies for the area began with

the first proposals of 1978, continues today, and is expected to continue into the future.

Citizens' organizations have been formed at both ends of the protection-development spectrum. There is a coalition of Ontario-wide environmental and naturalist groups working for tight development controls and environmental protection. It includes the Sierra Club, the Canadian Environmental Law Association and the Federation of Ontario Naturalists. This umbrella organization formed in 1978 when the original Niagara Escarpment Plan was being developed. It was active in both sets of hearings leading to the original and revised Plans of 1985 and 1994 respectively, as well as in community outreach and promotion of Escarpment protection. There are also several locally based groups interested in protection of specific portions of the Escarpment.



8. *The Niagara Escarpment Plan seeks to concentrate residential development in urban areas such as the City of Hamilton.*

In addition to the above groups which are generally supportive of the Niagara Escarpment Plan, organizations opposed to the Plan's restrictions were formed around the time of both development of the original Plan and the Five Year Review. Members of these groups are primarily private landowners and businesses on the Escarpment. Some have had development applications refused by the Niagara Escarpment Commission or have applications in progress. The groups generally believe that the Commission should be eliminated. They say that responsibilities for development control should be transferred to local elected officials, who might be more receptive to their development proposals. One of the groups has even requested that the biosphere reserve designation be suspended.

Between the two poles of Escarpment protection and development are numerous groups involved in day-to-day business enterprises related to their location on the Escarpment. In the Regional Municipality of Niagara, due south from Toronto, the Vintners Quality Alliance represents the interests of a growing number of small "estate" wineries. The hospitality industry is active throughout the Plan Area, offering ski resorts, golf courses,

bed and breakfast homes and four season recreational resorts. The Bruce Trail attracts some 500,000 hikers per year who contribute over \$30 million to local economies. The Niagara Escarpment Parks and Open Space System offers almost unlimited opportunities for passive recreation and nature appreciation.

The Plan Area also serves as a magnet for numerous kinds of scientific research, including pioneering work on cliff ecology.

In the Ontario Legislature, all three political parties — New Democratic, Liberal and Progressive Conservative — have official positions which strongly support the Niagara Escarpment Plan.

Individual members of the Legislature may express other views. For example, the member of the Legislature for Grey County, where opposition to the Plan is strong, frequently puts forward a bill to repeal the Niagara Escarpment Planning and Development Act and thereby abolish the Niagara Escarpment Commission.

One member of the governing party recently put forward his own bill proposing to prohibit all waste disposal sites in the Plan Area through the Environmental Protection Act, adding further protection for the Escarpment over and above that afforded in the Plan amendment discussed earlier. Although it is unusual for private bills to be approved, this one became law in June 1994. The private bill proved itself to be another mechanism for increasing protection of the Escarpment outside of the five-year review process, which coincidentally, culminated in the announcement of the revised Plan within days of the passage of the bill. A private company, which was part way through the environmental approvals process for a landfill site in the Plan Area when the bill was passed, recently filed a \$458 million legal action against the Ontario government.

In recent years, some county and regional governments have urged the provincial government to delegate to them the development control authority under the Plan now exercised by the Niagara Escarpment Commission. The Commission's role would be



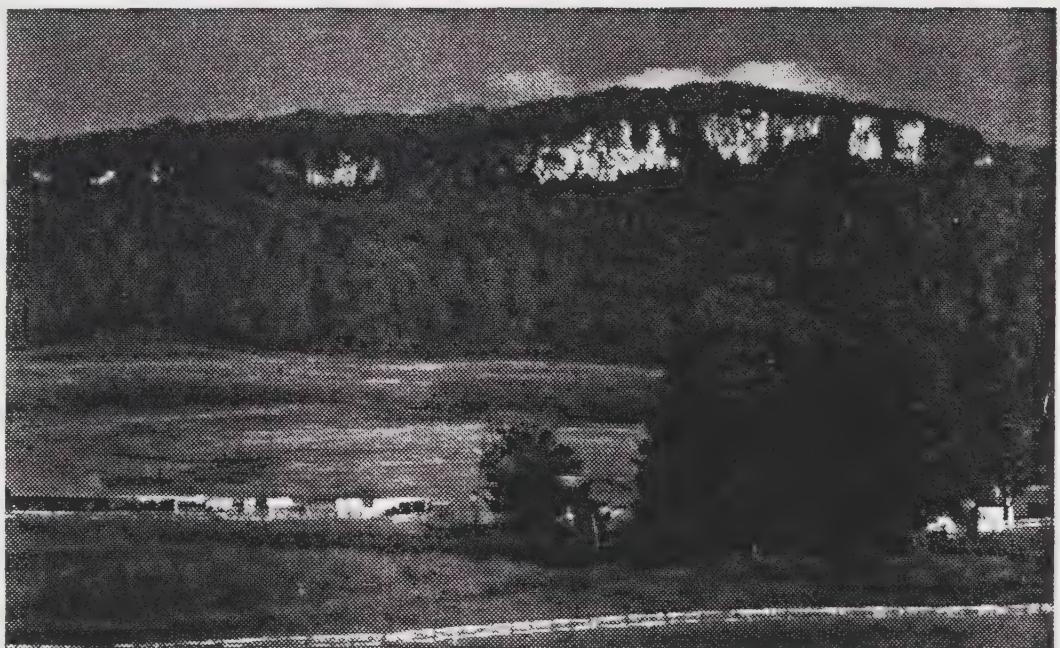
9. The wine industry in the Niagara Peninsula offers an ever-increasing selection of high quality vintages based on *vinifera* grapes.

reduced to that of an agency monitoring municipal land use planning decisions for adherence to the Niagara Escarpment Plan. The provincial government, through the Minister of Environment and Energy, has thus far turned down these requests. The Niagara Escarpment Plan Area is viewed as a resource of province-wide significance which merits consistent application of land use controls along the length of the Escarpment.

The concern is that some county and regional governments would be more accommodating to incompatible development proposals than the Niagara Escarpment Commission. This could result in "patchwork" implementation of the Plan which would be inconsistent with both the purpose and objectives of the legislation, and with the biosphere designation.

VI Conclusion

Thirty years of concern about protecting the Niagara Escarpment from inappropriate development has engendered broad public support for the Niagara Escarpment Plan and more recently, the biosphere reserve designation. Since designation in 1990, those supporting the Plan often cite the international recognition inherent in the biosphere reserve designation as further indication of the Plan Area's significance.



10. Prime near-wilderness hiking, such as at the Old Baldy lookout in Grey County, co-exists with agricultural production in the valleys.

There has been opposition in certain areas of the Escarpment by some private landowners directly affected by the Plan's restrictions. Implementation of the Niagara Escarpment Plan is demonstrable proof that the biosphere reserve concept is applicable to highly developed areas.

Figure 1 - The Niagara Escarpment Biosphere Reserve

Area of the Biosphere Reserve*

Niagara Escarpment Plan Area	183,694 ha
Bruce Peninsula National Park (portion outside Plan Area)	5,684 ha
Fathom Five National Marine Park (portion outside Plan Area)	1,275 ha
TOTAL	190,654 ha

CORE AREA

Escarpe Natural Area (includes portions of Bruce Peninsula National Park and Fathom Five National Marine Park that are Escarpment Natural)	48,403 ha
Bruce Peninsula National Park (minus that which is Escarpe Natural)	13,584 ha
Fathom Five National Marine Park (portion outside Plan Area + portion that is Escarpment Protection (land base), the remainder being Escarpment Natural)	1,415 ha
Total	63,402 ha

BUFFER AREA

Escarpe Protection Area (minus those parts of Bruce Peninsula National Park & Fathom Five National Marine Park that are Escarpment Protection)	65,193 ha
Escarpe Rural Area (minus those parts of Bruce Peninsula National Park that Escarpment Rural)	48,095 ha
Total	113,288 ha

TRANSITION AREA (ZONE OF CO-OPERATION)	
Urban Area	3,511 ha
E Escarpment Recreation Area	7,539 ha
Mineral Resource Extraction Area	2,914 ha
Total	13,964 ha

* Figures presented here reflect updated information since designation of the biosphere reserve in 1990.

Elevation

Lowest point: 98 metres asl (excluding Fathom Five National Marine Park)

Highest point: 532 metres asl

Biogeographic Region - Latitudinal trends are well displayed on the north-south trending Escarpment:

Deciduous Forest Region

At the south end, common vegetation communities include rich slope forests of Sugar Maple and Black Maple mixed with Tulip-tree and Red Elm. Drier slopes have oak-hickory forests of Red, White, Black and Chinquapin Oaks mixed with Bitternut, Shagbark and Pignut Hickories – all trees characteristic of the eastern deciduous forest region. Understorey species are largely southern ones such as Flowering Dogwood (*Cornus florida*), Running Strawberry bush (*Eonymus obovatus*) and Yellow Mandarin (*Disporum lanuginosum*).

Great Lakes-St. Lawrence Forest Region

All of the Ontario Niagara Escarpment north of the Niagara Peninsula occurs within this forest region. At its north end on the Bruce Peninsula, there are fire-successional forests of White Birch, Trembling Aspen and Eastern White Cedar, with boreal species such as Balsam Fir and White Spruce. Jack Pine occurs at the southern limit of its range. Understorey species include northern ones such as Striped Coralroot (*Corallorrhiza striata*) and Bearberry (*Arctostaphylos uva-ursi*) and such circumboreal species as Hudson's Club-rush (*Scirpus hudsonianus*). There is also a concentration of western species of flora and fauna in the northern half of the Escarpment. e.g., eight plant species have disjunct populations, including Trail-plant (*Adenocaulon bicolor*), Menzie's Rattlesnake-plantain (*Goodyera oblongifolia*), Holly Fern (*Polystichum lonchitis*) and Alaskan Orchid (*Piperia unalascensis*).

Climate

Maximum average temperature, warmest month:	29.9° C
Minimum average temperature, coldest month:	-7.1° C
Mean annual precipitation	818.5 mm (13% as snow)

Geology

E Escarpment formation: Ordovician and Silurian Periods
(420-445 million years BP)

Sedimentary rocks of the Niagara Escarpment:

limestones
dolostones
shales
sandstones

Biology

Flora

Over 1500 species of vascular plants (including 40% of Ontario's rare flora):

In the south: Cucumber-tree, Paw-paw, Green Dragon (*Arisaema dracontium*), Tuckahoe (*Peltandra virginica*), American Columbo (*Frasera virginiana*)

In the north: Rand's Goldenrod (*Solidago glutinosa ssp. randii*) and Roundleaf Ragwort (*Senecio obovatus*).

The threatened American Ginseng (*Panax quinquefolius*) occurs in rich Sugar Maple forests along much of the Escarpment.

Significant species endemic to the Great Lakes occur on the Bruce Peninsula portion of the Escarpment, including Lakeside Daisy, Dwarf Lake Iris, Hill's Thistle, Provancher's Philadelphia Fleabane and Ohio Goldenrod.

Ferns: 50 species recorded, including Wall-rue (*Asplenium ruta-muraria*), an Appalachian species rare in Canada. Most of the world population of the North American subspecies of Hart's-tongue fern (*Phyllitis scolopendrium var. americana*) occurs along the Escarpment.

Orchids: 37 species recorded in the northern parts of the Escarpment, including Calypso Orchid (*Calypso bulbosa*), Ram's-head Lady-slipper (*Cypripedium arietinum*) and Alaska Rein Orchid (*Piperia unalascensis*).

Oldest trees in eastern North America (1000 years):
Thuja occidentalis (Eastern White Cedar)

Fauna

Over 300 bird species (of which 200 species have shown evidence of breeding in the Niagara Escarpment). Of the breeding species, 25 are considered nationally or provincially endangered, threatened or vulnerable, including Bald Eagle, Red-shouldered hawk, Black Tern, Louisiana Waterthrush and Hooded Warbler.

55 mammal species and 34 species of reptiles and amphibians have been recorded. Rare species include the endangered North Dusky Salamander, the threatened Eastern Massasauga Rattlesnake, the vulnerable Southern Flying-squirrel and the rare Eastern Pipistrelle.

Photo Credits:

1. Richard A. Armstrong
2. Douglas Larson, University of Guelph
3. Niagara Escarpment Commission
4. Willy Waterton
5. Richard A. Armstrong
6. John Koegler, Geovisuals
7. John Koegler, Geovisuals
8. Richard A. Armstrong
9. Ontario Ministry of Culture,
Tourism and Recreation
10. Niagara Escarpment Commission

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